MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

ECE3156 – SOFTWARE ENGINEERING

(EE, CE, TE)

17 FEBRUARY 2023
09:00 A.M – 11:00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 7 printed pages only (including this page).
2. This is a closed book exam.
3. There are **FOUR (4) QUESTIONS** in this paper. **Answer ALL questions**. All questions carry equal marks (25 marks) and the distribution of the marks for each question is given.
4. Write your answers in the Answer Booklet provided.
5. State all assumptions clearly.

Question 1

Table Q1 describes the activity network information of a particular software engineering organization for a project that they are working on.

Table Q1: Activity network information.

Activity	Description	Preceding Activity	Activity Time (days)
A	Requirements gathering	—	20
B	Project plan	A	10
C	Design plan	B	17
D	Resource plan	B	8
E	Quality Assurance plan	D	8
F	Test plan	D, C	15
G	Design and Test approval	C, E	12
H	Development	G	30
I	Testing & Rework	F, H	20

(a) By using the information in Table Q1, draw a network diagram for the listed activities using Activity on Node (AON) method.

[3 marks]

(b) Redraw the network diagram based on the information in Table Q1 using the Activity on Arrow (AOA) method.

[5 marks]

(c) With reference to part (b), compute any slack time that exists in the individual activities.

(i) **Redraw** the AOA diagram. Draw the necessary Earliest Start Time (EST) and Latest Finish Time (LFT) boxes on the current AOA diagram of part (b).

(ii) Compute the Available Time (AT) for each activity followed with the float/slack time, if any.

[6 marks]

(d) With reference to part (b) and part (c), identify all of the possible critical paths for this project.

[2 marks]

(e) Draw the corresponding Gantt chart for the activities of this project based on a waterfall cycle.

[4 marks]

(f) Compute the durations (in days) of this project.

[1 mark]

(g) Illustrate the *systematic process* (from problem to solution) of software engineering with a diagram and then explain each process stage with your own words

[4 marks]

Continued...

Question 2

(a) Explain the following testing strategies, respectively:

(i) Security testing. [2 marks]

(ii) Load testing. [2 marks]

(iii) Compatibility testing [2 marks]

(iv) Beta testing. [2 marks]

(b) Describe four (4) characteristics of **testable software.** [3 marks]

(c)

```
LN1:   begin
LN2:   int a, b, pow;
LN3:   float c;
LN4:   input(a,b);
LN5:   if (b<0)
LN6:   pow=-b;
LN7:   else
LN8:   pow=b;
LN9:    c=1
LN10: while (pow!=0){
LN11: c=c*a;
LN12: pow=pow-1;
LN13: }
LN14: If (b<0)
LN15: c=1/c;
LN16: Output(c);
LN17: End
```

Program Listing Q2: Code snippet.

With reference to Program Listing Q2, construct a flow graph to illustrate the control structures in this code excerpt.

[6 marks]

(d) From part (c), calculate the cyclometric complexity for the corresponding code excerpts using the following methods:

(i) Region [2 marks]

(ii) Edge calculation. [2 marks]

(iii) Predicate methods. [2 marks]

(e) From part (c) and (d), provide the set of possible execution path of the program.

[2 marks]

Continued...

Question 3

(a) List the five (5) components of a design model.

[5 marks]

(b) A UML (Unified Modelling Language) diagram depicts the dynamic behaviour of a system or part of a system through the flow of control between actions that the system performs. Draw a **UML sequence diagram** when a customer wanted to withdraw cash with an automated teller machine (ATM). The following is a description of the ATM transaction.

ATM Transaction

The ATM will need to interact with the bank server and bank account. *(Create a **lifelines** for these 3 objects)*

A customer inserts their bank card at the ATM. The bank server then verifies the card is OK. The customer is prompted for a PIN which is entered via the ATM. If the card is NOT OK, ATM will eject the card.

Customer entered the PIN. If correct, he/she is presented with a menu to choose either to check balance or withdraw cash. If the PIN is incorrect, the card is ejected to the customer.

If customer choose to check balance, the bank server will request the balance of account from the bank account and to be displayed. Card is returned to customer.

If the customer chooses to withdraw cash, the customer is then prompted with a request for cash required and customer need to inputs the amount.

If the balance of the account is insufficient, a message is displayed on the screen. The card is returned to customer.

If there are sufficient funds in his/her account, the cash is dispensed, a receipt is printed, and the account balance is updated.

Before the cash is dispensed, the card is returned to the customer.

(Draw activation boxes for each object and alternative frames if necessary)

[9 marks]

(c) *Pair programming is an agile software development technique in which two programmers work together at one work station. One types in code while the other reviews each line of code as it is typed in. The person typing is called the driver. The person reviewing the code is called the observer. The two programmers switch roles frequently (possibly every 30 minutes or less).*

Suppose that you are asked to build a system that allows **Remote Pair Programming**. That is, the system should:

Continued...

- Allow the driver and the observer to be in remote locations, but both can view a single desktop in real-time.
- Each driver and observer need to key in 10 digit pin or security token from short messaging system (SMS), for them to be connected to the system after login in username and password. If successful, a "verified token" message will appear. If failed, "wrong token" will appear.
- The driver should be able to edit code and the observer should be able to "point" to objects on the driver's desktop.
- In addition, there should be a video chat facility to allow the programmers to communicate.
- The system should allow the programmers to easily swap roles and record rationale in the form of video chats.
- In addition, the driver should be able to issue the system to backup old work.

Draw a **Use Case diagram** for this system. You may use *<<include>>* and *<<extend>>* relationship in your diagram. You need to write your assumptions about the system.

[6 marks]

(d) Entity-Relationship Diagram (ERD) is one of the data modeling tools that provides a software engineer with the ability to represent data objects, their characteristics, and their relationships. Use an ERD to describe the following scenario.

- A PhD supervisor and co-supervisor are identified by their ID number (TID), last name (LName), and first name (FName), respectively.
- A project is identified by a project ID (PID) and title (T).
- A PhD student is identified by an ID number (SID), last name (LName), and first name (FName).
- A PhD supervisor can supervise zero, one, or many students but only up to 3 student as main supervisor and a student is supervised by one supervisor and one co-supervisor.
- A supervisor can propose one or many projects and every project is proposed by one supervisor.
- A PhD student must work on one project and every project and title is worked by only one student.

[5 marks]

Continued...

Question 4

(a) State the five steps in Object-Oriented Analysis.

[5 marks]

(b) Consider the ***air transportation system***, as follows:

- Many flights land and depart from city's airport.
- Some of the big cities may have more than one airport.
- Every flight belongs to specific airline.
- The planes may have many flights to different airports.
- Each plane is identified with serial number and model. E.g. hypersonic.
- There are specific pilots for each airline and they fly many flights.
- Each flight is identified by flight number and the date on which the flight is scheduled.
- The passenger reserves a seat for a flight.
- The seat is identified by a location.

Prepare a Unified Modelling Language (UML) **class diagram** for the *air transportation system* description above.

[12 marks]

Continued...

(c) Unified Modelling Language (UML) has been used widely in Software Engineering. For example, Use case diagram **usage** is to models the functionality of the system with regard to the outside users, called actors and is expressed as a transaction among actors and the system. A use case is a coherent unit of functionality expressed as a transaction among actors and the system. Use case diagram shows which actors participate in which use case.

Example of use case diagram **concepts**: Use case; Role; Association; Include; Extend

For each of the following UML diagrams, briefly explain **usage** of **how** is that diagram is used in designing a software system and major **concepts** used in it:

(i) Sequence Diagram.

[2 marks]

(ii) Class Diagram.

[2 marks]

(iii) Component Diagram.

[2 marks]

(iv) State Diagram.

[2 marks]

End of Paper